

# GARRETT-AIRESEARCH GAS TURBINES

## VERSATILE POWER AROUND THE WORLD

The past few years have seen dramatic progress in the development of gas turbines. This includes the gas turbines which power our large jets and turbo-prop transports throughout the world, as well as highly developed and refined gas turbines of lower horsepower which have proved their ability and versatility within a short few years. This is part of that story.

Twenty years ago The Garrett Corporation, Los Angeles, California, through its AiResearch Manufacturing Division, tackled the difficult job of building a small, lightweight, efficient gas turbine engine. The first engine was delivered to the U. S. Navy two years later to provide pneumatic auxiliary power on board the P5Y turboprop flying boat.

Since then, Garrett-AiResearch has designed, built, and delivered more

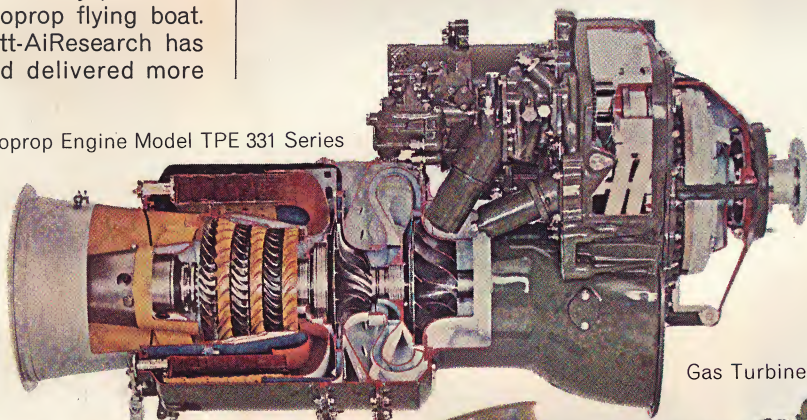
than 12,000 gas turbines ranging from 30 to 850 horsepower. Their uses range from auxiliary power units to prime propulsion units, from electrical generating sets to fuel pumpers, from starters for large jet engines to onboard power for hydrofoil boats.

Unlike some large gas turbine engine developers who have substantial military or commercial funding, Garrett-AiResearch developed and broadened its turbine family largely with company-sponsored research programs. Research has been essential in this area because the designing and building of

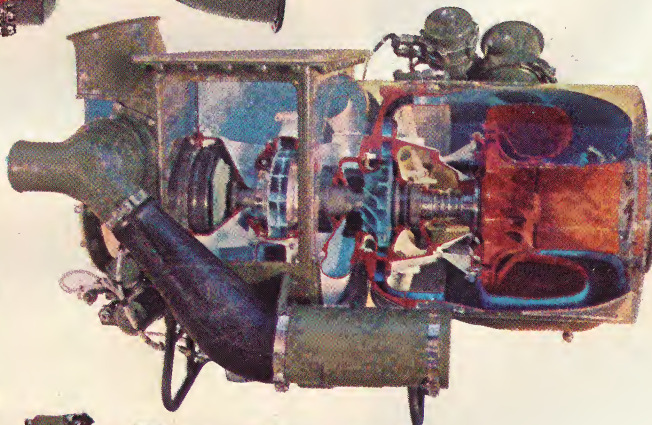
small gas turbine engines is a highly specialized art presenting many new problems, and cannot be done by scaling down the big engine techniques.

By utilizing the experience gained in producing more than 1,000,000 units in the fields of turbomachinery, heat transfer, and control systems for major military and commercial aircraft, Garrett-AiResearch has successfully introduced, and is now supplying many turbines for specific jobs. The flexibility and resources of Garrett-AiResearch engineering talent, fully equipped laboratories, unsurpassed manufacturing facilities, and world-wide service insures the finest gas turbine engines available.

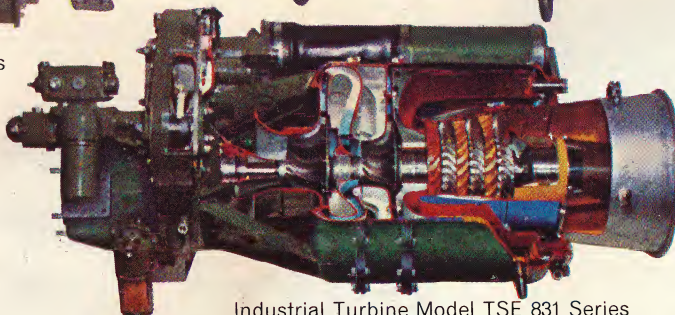
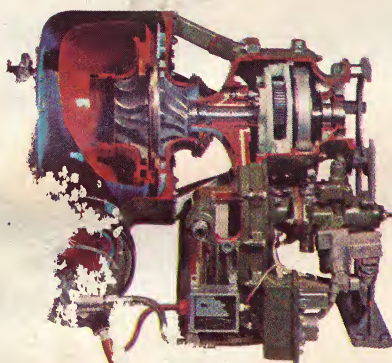
Turboprop Engine Model TPE 331 Series



Gas Turbine Compressor Model GTC 85 Series



Model G 30 Series



Industrial Turbine Model TSE 831 Series



Wherever power is needed—versatile power—you will likely find Garrett-AiResearch gas turbines. They are replacing gasoline and diesel reciprocating engines. They are creating wholly new uses for this class of power. Major advantages are their size, their power-to-weight ratio, and their acceptance of a broad range of fuels. Rugged machines, they operate in all types of climatic conditions without the problems associated with other engines. Inherently reliable because of fewer moving parts, they permit longer periods of operation between maintenance and overhaul. This provides versatile, reliable and economical service.

The following applications are typical of the many, many jobs being performed by Garrett-AiResearch gas turbines—around the world today.

#### AIRLINE AND BUSINESS AIRCRAFT

The AiResearch gas turbine flies with the world's major airlines as an onboard Auxiliary Power Unit. The APU provides power for main engine starting, ground air conditioning, and electrical power; it frees the



aircraft from ground support equipment, permits flexibility in the selection of airports, and helps bring jet aircraft service to smaller communities. Second generation jetliners,



now carrying AiResearch gas turbine auxiliary power units, include the Boeing 727, Douglas DC-9 and British Aircraft Corporation's BAC One-Eleven. Retrofit APU programs for earlier aircraft are also under way.



For business aircraft, these APU's provide aircraft self-sufficiency—even at isolated locations. Installations on such turbojet air-



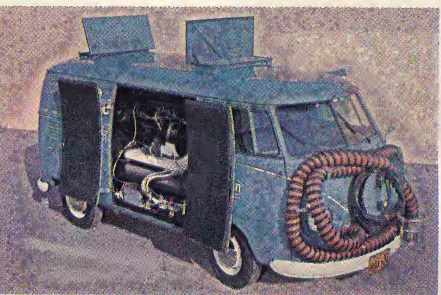
craft as the Lockheed Jetstar, the turboprop Grumman Gulfstream, and other contemporary business jets such as the DeHavilland DH-125, are indicative of the growing importance of time and convenience to the busy



executive. Garrett-AiResearch provides onboard APU's for business aircraft as standard option equipment.



Garrett-AiResearch ground support vehicles of various types are in wide use at airports the world over by more than forty airlines.



#### MILITARY APPLICATIONS

AiResearch turbine development for military use has paralleled that of commercial users. The need for onboard auxiliary power units for cargo and troop carrier aircraft, frequently



operating from remote areas, is essential. U. S. Air Force and U. S. Navy aircraft using AiResearch onboard gas turbines include the C-130, C-131, C-133, KC-135, P5M, P6M-2, and the P3A.

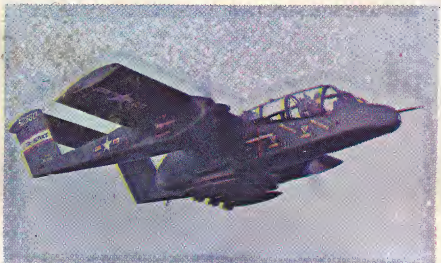
Other transports carrying these APU'S include: the U. S. Air Force C-141, the German Air Force "Transall," and the French Air Force Breguet "Atlantique."



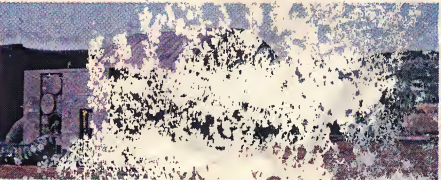
An important engine development now in production is the 660 horsepower, turboprop Model T76 Series. It has been selected by North American Aviation and the U. S. Navy for the Department of Defense OV-10A, a tri-service aircraft designed for "COIN" (COunter INsurgency) missions. The rugged,



easy to maintain engine is ideal for STOL requirements, and provides the fast response, maneuverability, and reliable performance so essential to the mission.



The gas turbine generator, coupled with air conditioning and a water source, now is providing electrical power, heating and cooling, as well as steam and hot water, for "MUST" (Medical Unit, Self-contained, Transportable), a mobile, inflatable hospital being used by the U. S. Army Medical Corps.





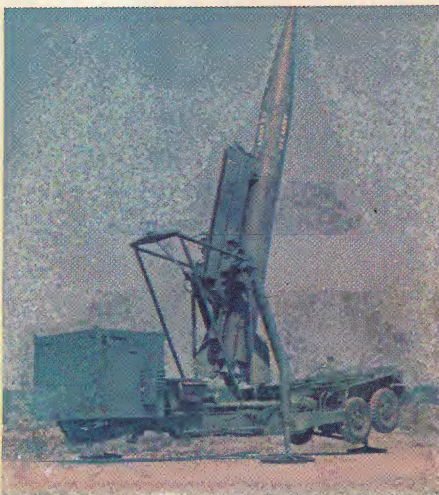
Dependable main engine starting of jet aircraft at military bases and aboard aircraft carriers is a basic requirement of the jet age.



Thousands of starting units have been produced by AiResearch, in dozens of configurations. For example, AiResearch starters have been packaged on tugs, on a variety of



towed vehicles, and even on sleds for arctic and antarctic uses; they have also been packaged in detachable, wing-carried configurations for airlifting to remote areas.



Above is a photograph of the Sergeant Missile Complex which includes a gas turbine missile support system as a part of the launch vehicle.



These gas turbine engine sets supply power for mobile, lightweight generator sets to produce electricity for electronic communications, radar and command centers, heat and cooling for electronic systems.

## CIVIL AIRCRAFT PROPULSION

Garrett-AiResearch applied its accumulated knowledge to the problem of a turboprop engine for medium sized business aircraft. Supported by the experience represented by thousands of small gas turbines, Garrett-AiResearch designed an engine specifically for this purpose. The result: the AiResearch



Turboprop Engine Model TPE 331. This engine—of fixed-shaft design, rated at 605 eshp—is a logical extension of the design principles of its sister engine, the military T76. Because the design includes a rugged centrifugal compressor, no inlet screens are



required, thus providing vital safety factors when operating in icing conditions. The engine has rapid reverse thrust for short field landings, an automatic negative torque sensing system for protection in the event of engine shut-down in flight, a single gearbox for weight reduction and easier servicing, instant power response, positive air restarts with windmilling propellers, and the ability to use propeller braking for control in fast descents.



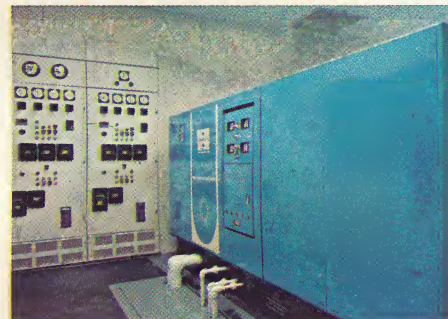
The engine is now being used in such aircraft as the Aero Commander "Turbo Commander." It has also been selected to power the Mooney Mitsubishi MU-2. The versatility of the engine is also apparent by the program of Volpar Incorporated. Volpar converts the popular Beech 18 business/personal aircraft from reciprocating to turboprop engines. This conversion is now available in kit form.



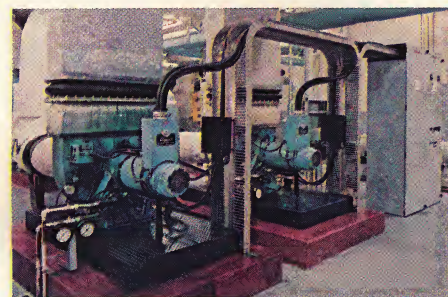
It is also interesting to note that the same engine has been selected for single engine installation in the Fairchild Hiller/Pilatus "Turbo Porter."

## INDUSTRIAL USES

Many major industries have watched the evolution of the small gas turbine with extreme interest. Now Garrett-AiResearch is producing Total Energy Systems for varied industrial uses.

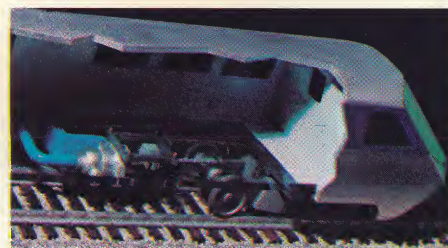


This is representative of a control panel for a sophisticated Total Energy System. Employment of gas turbines to power these total



energy systems frees the user from dependence on outside electrical power.

The heart of the Total Energy System is a natural gas fueled industrial gas turbine, rugged, simple and economical to maintain. It provides all of the electrical power, cooling, heating, steam and hot water for apartment buildings, shopping centers, office buildings and industrial plants.



Still another application of the Garrett-AiResearch gas turbine is represented in the modern approach to rapid transit. This includes the utilization of the turbine for prime propulsion of high-speed rail cars. A gas turbine can also provide air conditioning and heating for self-contained rail cars.

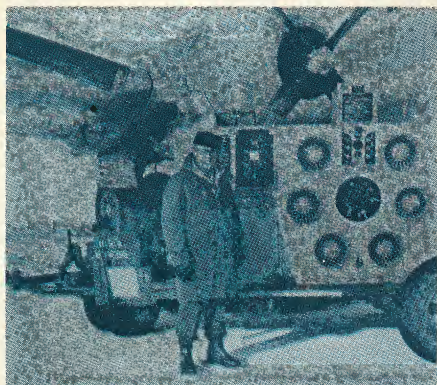


# GARRETT-AIRESEARCH WORLD-WIDE TOTAL PRODUCT SUPPORT

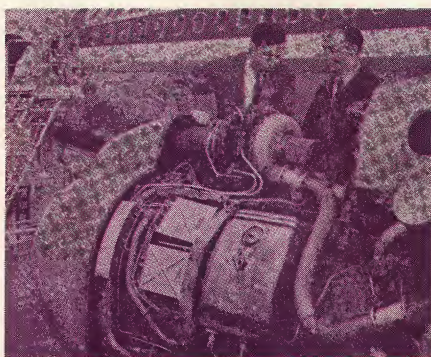
Garrett-AiResearch supplies versatile gas turbine power around the world, and provides service and support to the users of these products wherever they may be.

Along with the inherent reliability of Garrett-AiResearch gas turbines, there is also the inherent dependability of Garrett-AiResearch support programs.

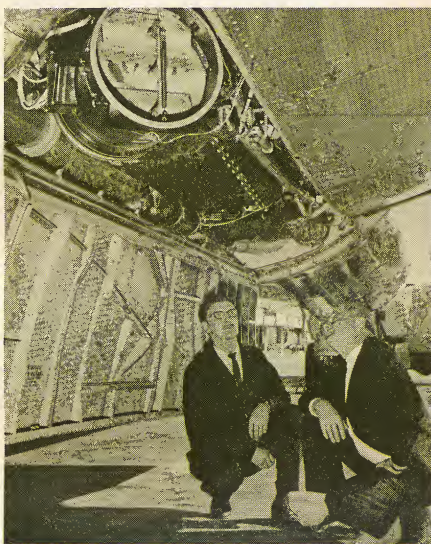
When The Garrett Corporation sells a product, it assumes the responsibility for the support of the product in the field—around the world! The result is a world-wide organization ready to serve the needs of thousands of customers whether it is for a simple component, or a complex system.



Trained technical personnel are available; spares can be supplied quickly to any area; highly skilled production specialists are available.



Garrett field service men are competent engineers who have a thorough knowledge of the design of Garrett equipment and how



it works. They take personal pride and interest in the customers' requirements from the Arctic to the Antarctic; from remote military bases in the jungle to oil companies in the desert; from a manufacturer in Tokyo or New York, to an airline in London or Paris. The field service engineer is the direct line of communication from the users back to the support services of



the appropriate Garrett division. The customer is "product-insured" by these men, and by the system of which they are an integral part, and also by the talents and experienced assistance of the same experts who provided the original design, manufacturing and testing of Garrett-AiResearch equipment.



AiResearch Manufacturing Division, Los Angeles, California  
AiResearch Manufacturing Division of Arizona, Phoenix, Arizona  
AiResearch Aviation Service Division, Los Angeles, California  
AiResearch Industrial Division, Los Angeles, California  
Garrett Supply Division, Los Angeles, California  
Airsupply Division, Santa Monica, California  
Air Cruisers Division, Belmar, New Jersey  
Garrett Manufacturing Limited, Toronto, Ontario, Canada  
Garrett International S.A., Geneva, Switzerland  
Garrett International S.A., Paris, France  
Garrett-AiResearch Limited, Slough, Bucks, England  
Garrett GmbH, Frankfurt am Main, Germany  
Garrett (Japan) Limited, Tokyo, Japan  
Garrett International S.A., Stockholm C., Sweden

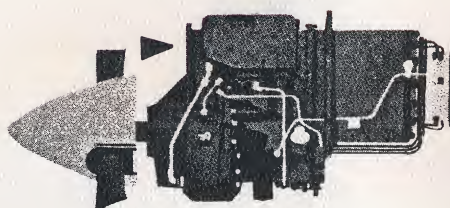




## TPE 331/T76 FIXED SHAFT ENGINES

### OPERATING CHARACTERISTICS

- AUTOMATIC START CONTROL
- SIMPLICITY OF OPERATION
- SAFE GROUND HANDLING
- RAPID POWER RESPONSE
- EXTRA SINGLE ENGINE SAFETY (N. T. S.)
- POSITIVE AIR RE-STARTS
- INTEGRAL ANTI ICING PROTECTION
- LOW FUEL CONSUMPTION
- CONTROLLED RAPID DESCENTS
- SMOOTH & RAPID REVERSE THRUST ON LANDING
- CONTROL SYSTEM SIMPLICITY

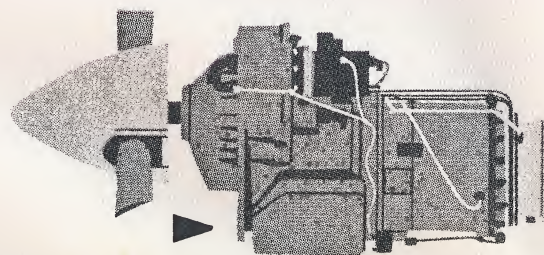
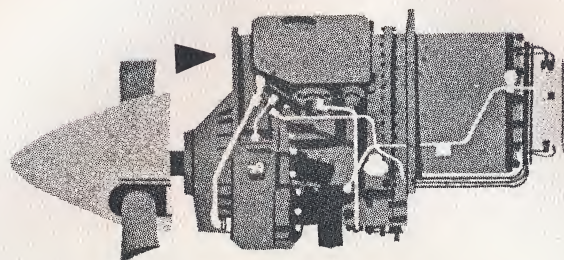






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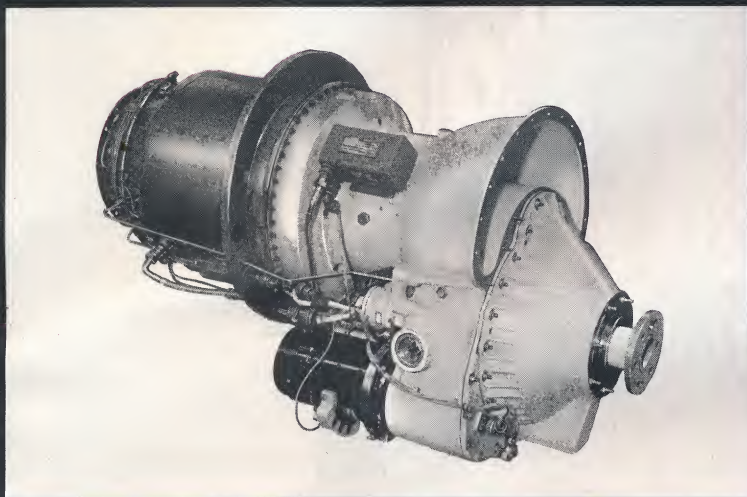
### DESIGN ADVANTAGES



- **SIMPLICITY**
- **RUGGEDNESS**
- **FEWER MOVING PARTS**
- **EFFICIENT RAM AIR RECOVERY**
- **EASE OF MAINTENANCE**
- **LOWER COST**
- **INCREASED RELIABILITY**
- **JET THRUST**
- **MEETS FAR 25 REQUIREMENTS**  
( NTS, BETA FOLLOW UP, ANTI ICING )



# The Garrett / AiResearch T76 Turboprop Engine



T76



NORTH AMERICAN OV-10A

## YT76 SPECIFICATIONS

<b>ENGINE TYPE</b>	Single-shaft turboprop with integral gearbox, two-stage centrifugal compressor, three-stage axial turbine, single annular combustion chamber
<b>WEIGHT</b>	304 lbs. (approx.)
<b>DIMENSIONS (APPROX.)</b>	Length 44½ in.; Width 19¼ in.; Height 27 in.
<b>PROPELLER SHAFT RPM</b>	2,000 (max.)
<b>PERFORMANCE RATINGS</b>	
<b>MILITARY</b>	660 shaft horsepower, 0.602 SFC
<b>NORMAL</b>	550 shaft horsepower, 0.627 SFC
<b>FUEL</b>	Mil-J-5624F(2), Grades JP-4 and JP-5
<b>OIL</b>	Mil-J-23699(1) (Wep) Type: Mobile Oil Jet II

## OPERATING CHARACTERISTICS

<b>RAPID POWER RESPONSE</b>	Acceleration from flight idle to full military power takes approximately one second.
<b>NEGATIVE TORQUE SENSING</b>	Automatic propeller drag reduction is provided by N.T.S. system by driving the propeller blade angle toward feather in case of fuel starvation or an in-flight engine shutdown.
<b>SIMPLICITY OF OPERATION</b>	Design simplicity permits a single lever power management control system.
<b>ANTI-ICING PROTECTION</b>	Bleed air anti-icing of inlet duct is an integral part of the engine.
<b>RUGGEDNESS</b>	Engine operation is unimpaired by high G forces imposed during rough field operations. Centrifugal compressor ruggedness and air flow geometry has demonstrated a high degree of resistance to F.O.D. and erosion.

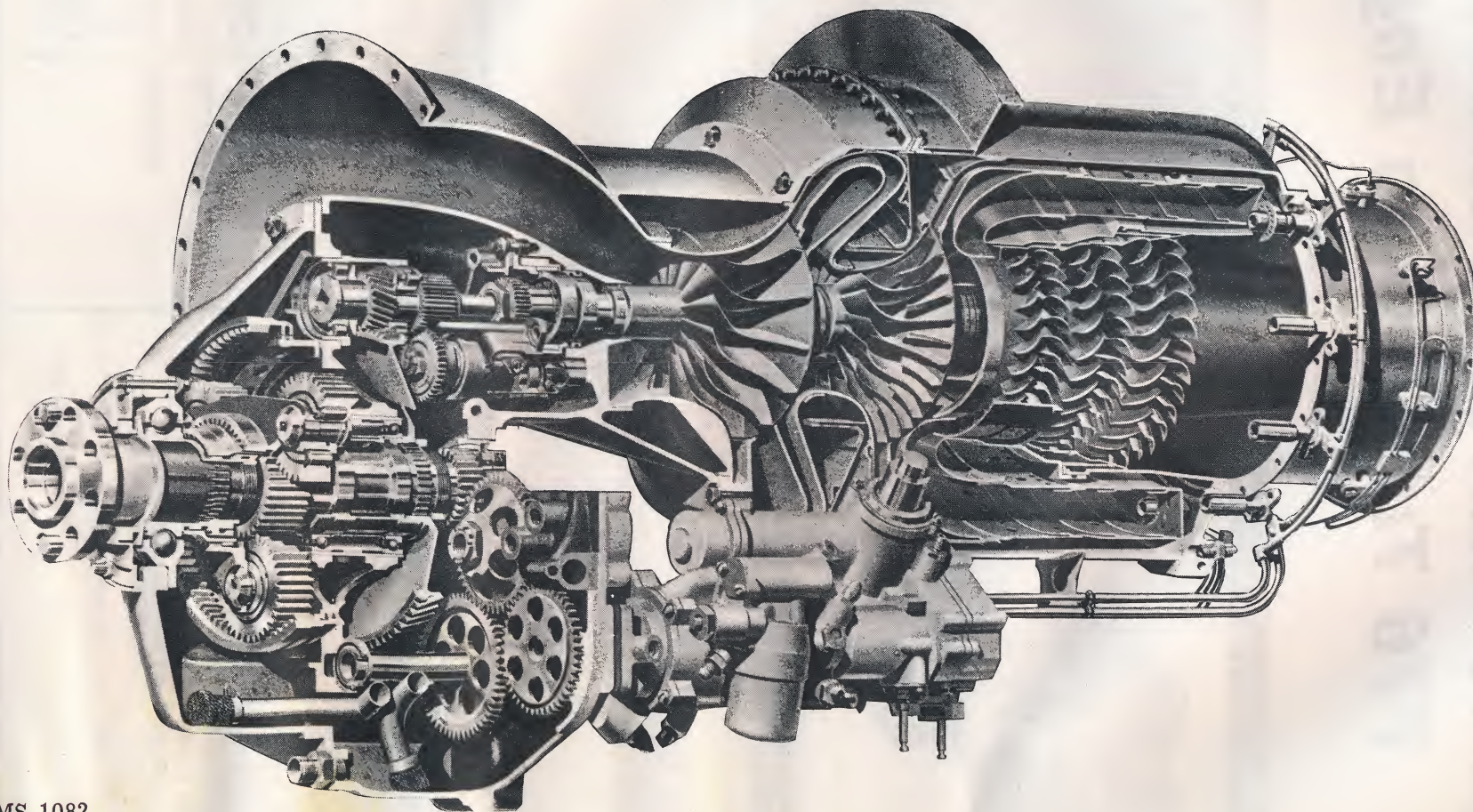


AIRESEARCH MANUFACTURING DIVISION OF ARIZONA • 402 SOUTH 36TH STREET • PHOENIX, ARIZONA 85034 • (602) 273-3011





## AIRESEARCH YT76 TURBOPROP ENGINE



MS 1082